What is claimed is:

1. A device for measuring fluid flow of flowing fluid comprising:
   A) a disturbance means for producing disturbances in the flow without obstructing said fluid flow,
   B) an optical unit for producing a light beam directed through said flowing fluid,
   C) a detector for monitoring at least a portion of said light beam after said light beam exits said flowing fluid,
   D) a processor for calculating flow values based on signals from said detector.

2. The device as in Claim 1 wherein said disturbance means comprises a heating unit.

3. The device as in Claim 1 wherein said disturbance means comprises a droplet injector.

4. The device as in Claim 1 wherein said flowing fluid is breathing air flowing through a respirator tube.

5. The device as in Claim 3 wherein said droplet injector is a water droplet injector.

6. The device as in Claim 5 wherein said optical unit comprises a pattern producing unit for producing an optical pattern in said flowing fluid.

7. The device as in Claim 5 wherein said optical unit comprises a lens grating for producing a spatially periodic pattern in said flowing fluid.

8. The device The device as in Claim 7 and further comprising a lens for focusing onto said detector light reflected or defracted from water droplets as said droplets pass through said spatially periodic pattern.

9. The device as in Claim 8 wherein said processor is programmed with an algorithm for converting time varying signals from said detector into temporal frequency information.

10. The device as in Claim 9 wherein said algorithm includes provisions for performing Fast Fourier Transform.

11. The device as in Claim 9 wherein said processor is also programmed with an algorithm for determining fluid flow rates using said temporal frequency information and spatial frequency information corresponding to said spatially periodic pattern.

12. The device as in Claim 5 wherein said detector is a detector array.

13. A device for measuring flow of a fluid comprising:

A) a laser and laser optics configured to direct laser beams produced by said laser through a flowing fluid to produce a flow perturbed laser beam,

B) an interference producing means for producing interference patterns in said flow perturbed laser beam,

C) two optical detectors defining a first detector configured to monitor at least one interference fringe defining a first interference fringe and a second detector configured to monitor at least one interference fringe other than said first interference fringe,

D) a correlation means comprising a computer processor for correlating data from said first and second detectors to determine flow rate of said fluid.

14. A device as in Claim 13 wherein said laser optics define a beam crossing location where said beam passes through said flowing fluid and further comprising at least one heating element configured to heat said fluid upstream of said crossing location.

15. A device as in Claim 14 wherein said fluid flow is alternately in opposite directions, defining a forward direction and a reverse direction, wherein said at least one heating element is two heating elements, one located upstream of said crossing location with flow in the forward direction and the other located upstream with flow in the reverse direction.

16. A device as in Claim 13 wherein said correlation means comprises an oscilloscope for comparing fringe data.

17. A device as in Claim 13 wherein said correlation means comprises analog to digital converter and a digital processor programmed to perform cross-correlation analysis to compare fringe data and to calculate flow velocity and direction from results of said cross correlations.

18. A device as in Claim 13 wherein said correlation means comprises analog to digital converter and a digital processor programmed to perform cross-spectral analysis to compare fringe data and to calculate flow velocity and direction from results of said cross spectrum.

19. A device as in Claim 13 wherein said correlation means comprises analog to digital converter and a digital processor programmed to perform cross-correlation analyses to compare low frequency fringe data to calculate flow velocity and direction from results of said cross-correlation for the onset of the flow and to perform running average and compute the number of zero crossing points per interval for high frequency fringe data to calculate the flow rate for the subsequent portion of the breathing cycle.

20. A device as in Claim 13 wherein said device is configured to monitor flow of a respirator.

21. A method of monitoring flow of a fluid comprising the following steps:
    A) producing optical perturbations in said flow at a first location,
    B) transmitting a laser beam through said flow downstream of said first location to produce a perturbed laser beam,
    C) measuring perturbations in at least two separate portions of said perturbed laser with at least two detectors, and
    D) comparing information from said at least two detectors to determine said flow.

22. A method as in Claim 21 wherein an oscilloscope is utilized to compare said information from said two detectors.

23. A method as in Claim 21 wherein said information from said two detectors are compared using an analog to digital converter and a digital processor configured with an algorithm to perform cross correlations.

24. A method as in Claim 21 wherein said information from said two detectors are compared using an analog to digital converter and a digital processor configured with an algorithm to perform cross spectral analysis.

25. A method as in Claim 21 wherein said information from said two detector are compared using an analog to digital converter and a digital processor is configured with an algorithm to perform cross correlation analysis to determine the flow velocity and flow direction at the onset of the flow during a portion of a breathing cycle and, during a subsequent portion of the breathing cycle to smooth the signal fluctuations in each array of said values by performing running averages of 4-8 values and to compute the number of zero crossing points during selected time intervals to calculate flow rate for the subsequent portion of the breathing cycle.

26. A device for measuring gas flow in a respirator tube comprising a flowing gas:
    A) a tube section having a transparent section to permit the passage of light through said flowing gas,
    B) optical elements for producing a spatially periodic pattern in said flowing gas
    C) a water drop injector for injecting water droplets into said flowing gas,
    D) a detector,
    E) a focusing element for focusing light reflected or refracted from said water droplets onto said detector as said water droplets pass through said spatially periodic pattern,
    F) a processor for converting signals from said detector into fluid flow information.